

What is claimed is:

1. An arrangement for the optical detection of a moving target flow for pulsed energy beam pumped radiation generation based on a plasma in which a target generator is provided for generating a target flow advancing along a path and an energy beam for plasma generation is directed to a defined interaction point of the path of the target flow, this interaction point being located in a vacuum chamber for plasma generation, comprising:

said target generator providing a target flow of moving material with relatively constant target states in the interaction point;

said target flow having, at least in a recurring manner over time, identical conditions for the generation of plasma for radiation emission;

a sensor unit being provided for observation of the position of the target flow at a detection point which lies at a short distance from the interaction point on the path;

said sensor unit being provided for illuminating the target flow moving past with transmission light and for receiving proportions of the transmission light that are reflected at a portion of the illuminated target flow;

said sensor unit containing a detection module and a projection module, wherein the projection module having means for focusing the transmission light onto the detection point in the target flow, so that transmission light which is reflected from the detection point is received simultaneously by the projection module and is directed to the detection module;

said detection module being arranged at a spatial distance from the projection module so as to be shielded from interfering influences from plasma generation and resulting radiation; and

a light waveguide being provided between the detection module and projection module for transmitting transmission light and optical signals resulting from reflected portions of the transmission light at the target flow passing the detection point.

2. The arrangement according to claim 1, wherein the target flow is a flow of discrete liquid drops, wherein the projection module is oriented in lateral and longitudinal direction with the detection point to the middle path of the drops for detecting the drops.

3. The arrangement according to claim 1, wherein the target flow is a flow of discrete solid, frozen targets.
4. The arrangement according to claim 1, wherein the target flow is a continuous liquid jet.
5. The arrangement according to claim 4, wherein the projection module is directed with its detection point to the center of the target flow for detection of lateral variations.
6. The arrangement according to claim 4, wherein the projection module is directed with its detection point to an edge area of the target flow for detecting lateral variations.
7. The arrangement according to claim 1, wherein the projection module is arranged with its optical axis substantially orthogonal to the direction of the path of the target flow and essentially different than the direction of the axis of the energy beam, said energy beam being preferably an excitation laser.
8. The arrangement according to claim 7, wherein the projection module is arranged with its optical axis essentially orthogonal to the direction of the axis of the excitation laser.
9. The arrangement according to claim 1, wherein the projection module has focusing optical elements for coupling the transmission light out of the light waveguide and for focusing on a spatial region having a smaller extent than the lateral dimension of the target flow.
10. The arrangement according to claim 9, wherein the projection module has focusing optics with a focal length of a few centimeters and a numerical aperture that is selected in such a way that a focus of the transmission light generated by the focusing optics in the detection point is smaller than the diameter of the target flow and proportions of the

transmission light reflected by the latter are received.

11. The arrangement according to claim 1, wherein the projection module is directed with its optical axis to a detection point which is at a distance along the path of the target flow of several millimeters to several centimeters from the interaction point of the excitation laser beam, wherein the optimal distance from the interaction point must be adjusted as a compromise between desired economical compactness of the projection module and the necessary accuracy of position determination of the target at the interaction point.

12. The arrangement according to claim 11, wherein the optical axis of the projection module is at a distance of several centimeters to decimeters from the interaction point, wherein, for a relatively large distance from the interaction point such as this, the projection module has simple focusing optics with a short focal length and a defined numerical aperture, so that a high resolution of the target position is possible at a short distance from the detection point.

13. The arrangement according to claim 11, wherein the optical axis of the projection module is at a distance of only a few millimeters from the interaction point, wherein, at such a short distance from the interaction point, the projection module has focusing optics with a long target-side focal length of several centimeters but the same numerical aperture as with short focal length positioning, so that exacting focusing optics are provided for a high resolution of the target position at a great distance from the detection point.

14. The arrangement according to claim 11, wherein the projection module is directed with its optical axis to the target jet in a detection point in front of the interaction point.

15. The arrangement according to claim 11, wherein the projection module is directed with its optical axis to the target jet in a detection point after the interaction point.

16. The arrangement according to claim 1, wherein the detection module has

optical elements for generating the transmission light, for coupling the transmission light into the light waveguide and for coupling the transmission light out of the light waveguide, optical components for separating proportions of the transmission light that are reflected or backscattered in the detection point as optical measurement signals, and an optoelectronic detector for converting the optical measurement signal into an electric signal.

17. The arrangement according to claim 16, wherein the optical component for separating the optical measurement signal is a light waveguide with integrated direction-dependent signal splitting, particularly a fiber-optic circulator.

18. The arrangement according to claim 16, wherein the optical component for separating the optical measurement signal is a polarization-optical beam splitter, wherein the transmission light is linearly polarized.

19. The arrangement according to claim 18, wherein a polarization-preserving fiber is provided as light waveguide between the detection module and projection module.

20. The arrangement according to claim 18, wherein the detection module has an additional half-wave plate for adjustment of the polarization plane.

21. The arrangement according to claim 16, wherein the detection module contains an additional spectral filter element with high transmission for the optical measurement signal reflected by the target flow and a high blocking effect for scattered light originating from the laser beam and plasma.

22. The arrangement according to claim 16, wherein a continuous transmission light source with a collimated light bundle is provided for generating the transmission light.

23. The arrangement according to claim 22, wherein the transmission light source has a wavelength which is different than the wavelength of the excitation laser.

24. The arrangement according to claim 22, wherein the transmission light source is a waveguide-coupled luminescent diode, preferably a fiber-coupled luminescent diode.

25. The arrangement according to claim 22, wherein the transmission light source is a fiber laser.

26. The arrangement according to claim 22, wherein the transmission light source is a multimode laser diode.

27. The arrangement according to claim 22, wherein the transmission light source is a short pulse laser with a high repetition rate.

28. The arrangement according to claim 25, wherein the light waveguide between the detection module and the projection module uses a single-mode fiber, so that only one fundamental mode of the laser radiation used as transmission light can be transmitted.

29. The arrangement according to claim 18, wherein rotatable wedge plates are provided in the detection module for orienting the transmission light bundle before entering the light waveguide.

30. The arrangement according to claim 1, wherein the detection module is connected via the output of its detector to an electronic circuit for amplifying and processing the electric signal converted from the reflected optical signals and for generating a synchronization signal.

31. The arrangement according to claim 30, wherein the electronic circuit communicates with the pulsed energy beam source for generating a synchronization signal.

32. The arrangement according to claim 30, wherein the electronic circuit communicates with the target generator for generating a synchronization signal.